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# FLOOD INSURANCE STUDY

COMPLETED

## CITY OF ST. LOUIS, MISSOURI

INDEPENDENT CITY

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REVISED

SEPTEMBER 16, 1988

Federal Emergency Management Agency

COMMUNITY NUMBER - 290385

ORIGINAL

## NOTICE TO
## FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

This publication incorporates revisions to the original Flood Insurance Study. These revisions are presented in Section 9.0.

TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | INTRODUCTION | 1 |
| 1.1 | Purpose of Study | 1 |
| 1.2 | Coordination | 1 |
| 1.3 | Authority and Acknowledgments | 1 |
| 2.0 | AREA STUDIED | 2 |
| 2.1 | Scope of Study | 2 |
| 2.2 | Community Description | 2 |
| 2.3 | Principal Flood Problems | 4 |
| 2.4 | Flood Protection Measures | 5 |
| 3.0 | ENGINEERING METHODS | 7 |
| 3.1 | Hydrologic Analyses | 7 |
| 3.2 | Hydraulic Analyses | 9 |
| 4.0 | FLOOD PLAIN MANAGEMENT APPLICATIONS | 10 |
| 4.1 | Flood Boundaries | 10 |
| 4.2 | Floodways | 10 |
| 5.0 | INSURANCE APPLICATION | 16 |
| 5.1 | Reach Determinations | 16 |
| 5.2 | Flood Hazard Factors | 16 |
| 5.3 | Flood Insurance Zones | 17 |
| 5.4 | Flood Insurance Rate Map Description | 17 |

TABLE OF CONTENTS (Continued)


| | | Page |
|---|---|---|
| 6.0 | OTHER STUDIES | 19 |
| 7.0 | LOCATION OF DATA | 19 |
| 8.0 | BIBLIOGRAPHY AND REFERENCES | 19 |
| 9.0 | REVISIONS DESCRIPTION | 22 |
| 9.1 | First Revision (Revised September 16, 1988) | 22 |
| a. | Acknowledgments | 22 |
| b. | Scope | 22 |
| c. | Hydraulic Analysis | 22 |
| d. | Floodways | 22 |
| e. | Other Studies | 22 |
| f. | References and Bibliography | 23 |


FIGURES


| | | | | |
|---|---|---|---|---|
| Figure | 1 | - | Vicinity Map | 3 |
| Figure | 2 | - | Floodway Schematic | 15 |


TABLES


| | | | | |
|---|---|---|---|---|
| Table | 1 | - | Summary of Discharges | 8 |
| Table | 2 | - | Floodway Data | 12 |
| Table | 3 | - | Flood Insurance Zone Data | 18 |

TABLE OF CONTENTS (Continued)

EXHIBITS


Flood Profiles

| | | |
|---|---|---|
| Mississippi River | Panels 01P-02P | 24-25 |
| River Des Peres | Panels 03P-06P | 26-29 |
| Rock Creek | Panel 07P | 30 |
| No Name Creek | Panel 08P | 31 |
| Deer Creek | Panel 09P | 32 |

Flood Boundary and Floodway Map Index
Flood Boundary and Floodway Map

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
CITY OF ST. LOUIS, MISSOURI

## 1.0 INTRODUCTION

### 1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the City of St. Louis (independent city) Missouri, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of the information will be to convert the City of St. Louis to the regular program of flood insurance by the Federal Insurance Administration (FIA). Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

### 1.2 Coordination

The City of St. Louis Department of Building Regulations provided information pertaining to areas of flooding problems. Identification of streams requiring detailed study was determined in a meeting attended by personnel of R.W. Booker and Associates, Inc., the FIA, and officials of the Department of Building Regulations on April 19, 1976.

Study results were coordinated with Flood Insurance Studies for the City of Maplewood, Missouri, prepared by the Soil Conservation Service (SCS), and the City of Clayton, prepared by Stanley Consultants Incorporated.

Hydrologic and hydraulic data for the Mississippi River, including high water profiles and stage frequency data, were furnished by the St. Louis District Corps of Engineers. The U.S. Geological Survey supplied hydrologic data on the River Des Peres Drainage Basin.

A final meeting to review the draft of this report was held with city officials on November 29, 1977.

### 1.3 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by R.W. Booker and Associates, Inc., for the Federal Insurance Administration under Contract No. H-4028. This work, which was completed in June 1977, covered all significant flooding sources in the City of St. Louis.

## 2.0 AREA STUDIED

### 2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of St. Louis. The area of study is shown on the Vicinity Map (Figure 1).

In accordance with discussions held with city officials, floods caused by the Mississippi River, River Des Peres, Rock Creek and No Name Creek were studied by detailed methods. Due to the essentially full development of the flood plains of both the Mississippi River and River Des Peres and the flood control measures presently in place on these streams, it is expected that the finding of this Flood Insurance Study will be valid for a relatively long period.

### 2.2 Community Description

The City of St. Louis, Missouri, is located in the east central portion of the state along the west bank of the Mississippi River. The city encompasses an area of 61 square miles and has approximately 20 miles of river frontage. The population of 856,796 in 1950 declined to 622,236 in 1970 (Reference 1).

On the eastern boundary of St. Louis, all adjacent communities lie in the Illinois counties of Madison and St. Clair. Along the western and southern boundary there are twelve incorporated communities and the unincorporated areas of St. Louis County. The incorporated communities are Riverview, Bellefontaine Neighbors, Jennings, Pine Lawn, Hillsdale, Wellston, University City, Clayton, Richmond Heights, Maplewood, Shrewsbury and Mackenzie.

Three major interstate highways traverse the city, including U.S. Interstate 70 on the north, U.S. Interstate 44 through the central portion, and U.S. Interstate 55 on the south. Additionally, U.S. Highway 40 and 66 supplement the major interstate system.

Numerous railroads cross through the city. The major lines are the Missouri Pacific, Norfolk & Western, Frisco, Burlington, and the Terminal Railroad Association.

Industrial areas lie along the river and generally follow the railroads. The central business district is located in the east central part of the city and numerous service and commercial establishments follow the major thoroughfares.

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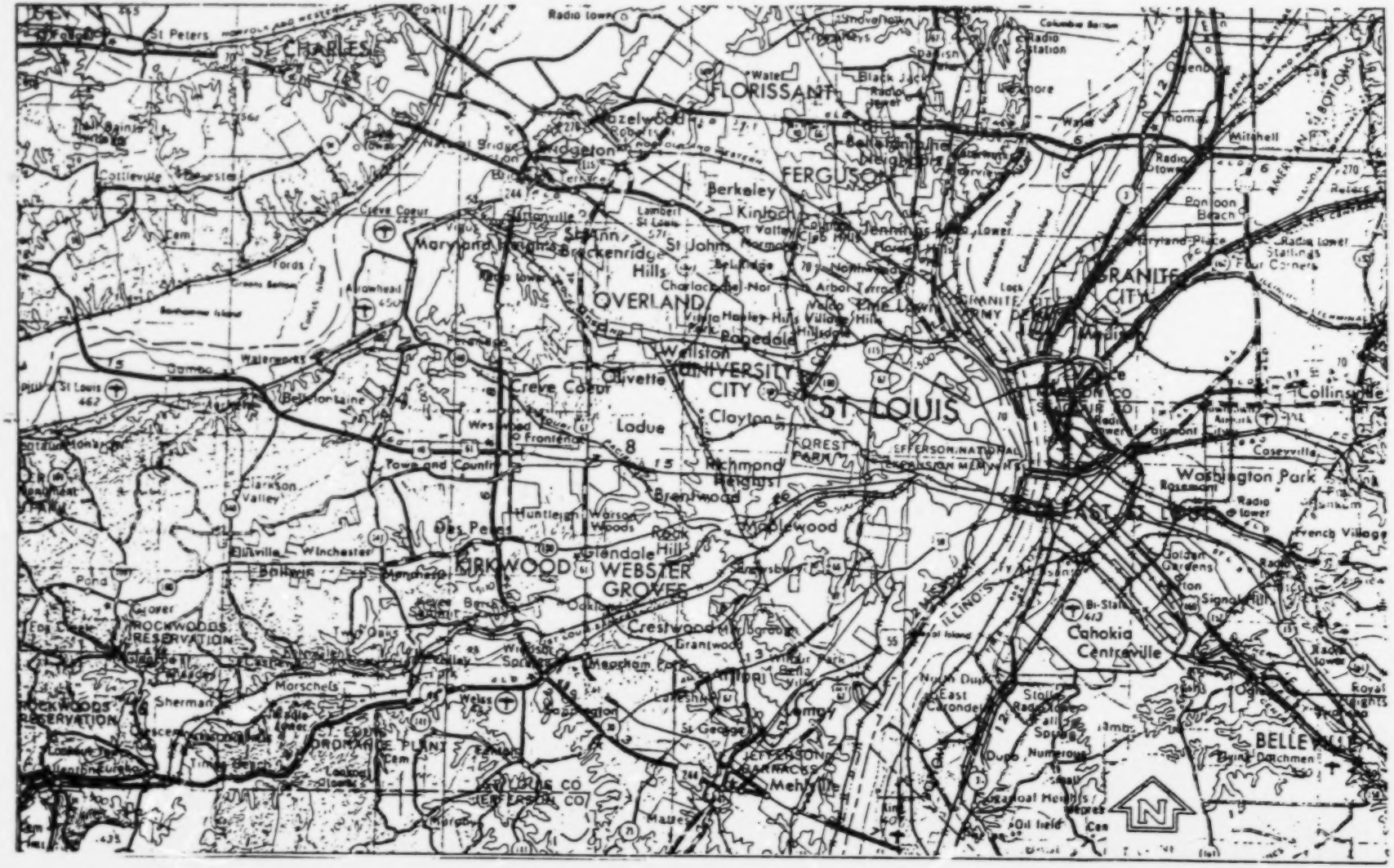


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

## CITY OF ST. LOUIS, MO
(INDEPENDENT CITY)

APPROXIMATE SCALE

4 0 4 8 12 MILES

## VICINITY MAP

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Climate for the area is typified by the following seasonal temperature variations (degrees F).

| Season | Average High (F) | Average Low (F) |
|---|---|---|
| Winter | 46 | 25 |
| Spring | 67 | 44 |
| Summer | 86 | 64 |
| Fall | 69 | 47 |

Temperature extremes have ranged from -20 degrees F to 110 degrees F. Annual precipitation averages approximately 37 inches, distributed fairly evenly throughout the year. Monthly precipitation will vary from approximately 1.5 inches per month in December, January, and February, to 4.5 inches per month in May, June, and September (Reference 2).

The topography of the community is mostly gently rolling terrain, except for the flood plain areas along the Mississippi River. With the exception of the major parks and part of the flood plain, the entire area is urbanized. River Des Peres, which lies in the southwestern sector of the city, has a drainage area of over 100 square miles. In the northern area, the Baden watershed drains approximately 8 square miles, and the Mill Creek watershed, which runs through the central portion of the city, also has an 8 square mile drainage area.

Soils in the City of St. Louis are of the Urban Land-Harvester Association. These soils consist mainly of deep, moderately well-drained loessial soils which have been converted to urban uses. The Urban Land-Harvester Association is composed of twelve different soil and landscape conditions or mapping units. The most abundant ones are the Urban Land-Harvester Complex, Winfield Silt Loam-Urban Land Complex, and Menfro Silt Loam Complex. The Urban Land-Harvester soil was mostly Menfro or Winfield before it was rearranged for building sites by cutting, filling, leveling and benching. The Menfro Silt Loam-Urban Land Soils are closer to the Mississippi River than the Winfield Silt Loam-Urban Land soils, although they are both on the same kind of landscapes. Of the minor soils, a different dark surfaced soil, the Shaw-Urban Land Complex occurs in the vicinity of Tower Grove Park and O'Fallon Park. The urbanized flood plains are mapped as Maline Soils-Urban Land Complex (Reference 3).

## 2.3 Principal Flood Problems

Most of the City of St. Louis is situated in the upland area above the flood plains of the Mississippi River and River Des Peres.

These areas are completely urbanized with storm water being conveyed through underground conduit systems. The potential for flooding in these upland areas from a storm of the 100-year recurrence interval is created by underground conduit systems incapable of conveying the entire flow.

Minor flooding in the form of ponding in intersections and shallow sheet flow would occur throughout these systems. In some isolated areas flooding depths could reach several feet. Due to the urbanization of the area, thunderstorm type activity with associated high intensity rainfall of short duration would produce the most severe flooding. This type of flood is characterized by rapid accumulation in ponding areas and along streets but the duration is usually limited to several hours.

The area of the city that lies along the Mississippi River flood plain is for the most part protected by levees or flood walls which extend from Chippewa Street (Mile 176.3) to Maline Creek (Mile 187.2). The area protected encompasses some 3,200 acres and includes many industrial and commercial establishments. The type of flooding which could occur in these areas would be of the same general nature as described for upland areas. In the immediate area of the flood wall, several pumping stations have open sump ponds. In these areas, sump levels would fluctuate as a function of storm intensity and pump capability.

The greatest potential for flood damage exists along River Des Peres where residential, commercial, and industrial areas exist in the flood plain and are subject to backwater flooding from the Mississippi River. Much of this area was under water during the flood of 1973. This flood had a magnitude which was about equal to a 30-year frequency flood. A record duration of 77 consecutive days above flood stage (March 10 to May 25) was established during this flood, which exceeded the old record of 63 consecutive days (May 16 to July 18) set in 1844. On April 28, 1973, a maximum discharge of 851,000 cubic feet per second was reached and measured 43.17 feet on the St. Louis gage. The flood of June 27, 1844 reached a stage of 41.32 feet, and based on flood marks, the U.S. Army Corps of Engineers (COE) estimated the discharge of 1,300,000 cubic feet per second. From a comparison of the discharge-stage relationship the effects of urbanization in the flood plains and associated levee construction are apparent. The 1973 flood, which was only 65 percent of the 1844 record discharge, resulted in a river stage of 1.85 feet higher (Reference 4).

A river stage of approximately 47.0 feet, which is 427.0 feet National Geodetic Vertical Datum of 1929 (NGVD), would be associated with a 100-year flood event at the St. Louis Gage, and at the mouth of River Des Peres, the 100-year flood elevation would be 421 feet NGVD (Reference 5).

## 2.4 Flood Protection Measures

The Missouri and Mississippi River basins above the City of St. Louis have a combined drainage area of 710,000 square miles. The two basins lie in portions of 12 states stretching from the Great Lakes to the Continental Divide. Throughout this vast area are many lakes and reservoirs from small

farm ponds to multi-purpose reservoirs, all of which combine to moderate flows in the rivers and thereby provide a degree of flood protection for the City of St. Louis.

To provide protection to low-lying industrial, commercial, and residential areas along the Mississippi River, the City of St. Louis agreed to act as local sponsor for a COE flood protection project. In May 1955, a city bond issue was authorized by referendum vote to provide $7,547,000 for the cost of local cooperation (Reference 6). Construction of the flood protection project in the City of St. Louis was authorized by Act of Congress dated August 9, 1955, Public Law 256, 84th Congress, 1st session. The project was designed to present overtopping of floodwalls or levees by the design flood of 52-foot stage.

The project is divided into two sections. The first begins at Chippewa Street (Mile 176.3) and extends 16,580 feet. There are 14 closure structures and eight pumping stations. The second reach begins at Eads Bridge (Mile 180) and extends 40,803 feet to Maline Creek (Mile 187.2). There are 20 closure structures and 13 pumping stations, the largest of which has a capacity of 4,122 cfs. The flood control measures on the Mississippi River within the corporate limits of St. Louis are designed to protect the community from greater than a 500-year flood.

Improvements to the original meandering River Des Peres channel were made in the 1930s. The channel was enclosed in conduit from the city limits through Forest Park to a point just south of Manchester Road. For the remainder of the downstream reach, the channel was straightened and a trapezoidal section was constructed with bottom widths of 50 feet at the end of the conduit increasing to 100 feet at the mouth. Side slopes of approximately 3 horizontal to 1 vertical were paved with rip rap except where crossing through natural rock cuts. Flood flows up to the 50-year recurrence interval can generally be contained within the banks of the channel. The downstream reach from Rock Creek to the mouth can contain the River Des Peres 100-year flow although, in this area, Mississippi flooding extends over the top of the banks.

Along the River Des Peres flood plain, temporary levees were constructed during the 1973 flood and remain in place along the reach between Broadway and Courtois Avenue. In addition, a floodwall is now under construction along the south bank of River Des Peres between the Missouri Pacific Railroad bridge and Broadway to protect a Defense Mapping Agency Aerospace Center facility. The levees and floodwall have top elevations of 420 feet NGVD and are not quite high enough to contain the 100-year flood which is at elevation 421 feet NGVD. The levees along River Des Peres, which extend from near the mouth to 10,500 feet upstream, afford protection from a Mississippi River flood with a recurrence interval of approximately 75 years. The St. Louis Metropolitan Sewer District has installed permanent gated structures at ten locations on storm sewers which empty into the



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lower reaches of the stream to protect against backwater flooding. Two locations have permanent pump installations and the remainder use drop in pumps when needed. Thirteen other locations have flap or slide gates and six additional locations have inflatable balloons. In all these instances pumps are temporarily placed in manholes to remove the flows. Pumps are generally sized to handle flows from one inch of rain for one hour.

## 3.0 ENGINEERING METHODS

For flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Floods having recurrence intervals of 10-, 50-, 100-, and 500-years have been selected as having special significance for flood plain management and for flood insurance premium rates. The analyses reported here reflect current conditions in the drainage areas of the streams.

### 3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in the community.

Flood frequency determinations on the Mississippi River have been based on statistical analyses of stream gaging records, utilizing model computer calculations by the COE, St. Louis District. Frequency-discharge data for floods on the Mississippi River having 10-year, 50-year, 100-year, and 500-year recurrence intervals were developed using the Mississippi Basin Model at Clinton, Mississippi (Reference 5).

Frequency-discharge data for Rock Creek and No Name Creek were determined by empirical formulas given in a U.S. Geological Survey (USGS) Open File Report (Reference 7).

Frequency-discharge data for River Des Peres was determined by rainfall-runoff techniques based on the unit hydrograph theory. There are seven short term (6 years) USGS stream flow and rainfall gages located in the River Des Peres Basin. Data from five of these stations which are located on Gravois Creek, Deer Creek and the upper reaches of River Des Peres was analyzed to determine basin characterstics. The COE HEC-1 computer program (Reference 8) was used to optimize several storms on each gage to determine unit hydrograph parameters. Lag times of the major tributaries were analyzed and it was determined that there were no coincidental peaks assuming uniform area distribution of rainfall. Using the results of the stream gaging analysis to select Snyder's synthetic unit hydrograph relationships (Reference 9), values of $C_t$=0.82 and $C_p$=0.88 were assumed. Rainfall



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amounts for 10-year to 100-year recurrence intervals were determined from Technical Paper No. 40 (Reference 10) and applied to the unit hydrographs. Several storm durations were tested to determine which produced the highest peak discharge. Rainfall excess amounts were derived by the SCS curve number method (Reference 11) and were checked against the values obtained from actual storm runoffs for reasonableness. Discharges computed by several other methods were compared to determine the general validity of the selected values.

Discharge for the 500-year floods in the River Des Peres Basin was determined by straight line extrapolation of a log-probability graph of flood discharges computed for frequencies up to 100 years.

The peak discharge-drainage area relationships for the selected recurrence intervals are presented in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

| FLOODING SOURCE AND LOCATION | DRAINAGE AREA (sq. miles) | PEAK DISCHARGES (cfs) 10-YEAR | 50-YEAR | 100-YEAR | 500-YEAR |
|---|---|---|---|---|---|
| MISSISSIPPI RIVER | | | | | |
| River Mile 180 | 701,000 | 690,000 | 925,000 | 1,020,000 | 1,250,000 |
| RIVER DES PERES | | | | | |
| Missouri-Pacific Railroad | 106.8 | 28,300 | 41,300 | 48,000 | 62,900 |
| Missouri-Pacific Railroad | 82.8 | 23,800 | 34,700 | 40,300 | 52,800 |
| Gravois Road | 78.4 | 23,000 | 33,600 | 39,000 | 51,100 |
| Watson Road | 68.5 | 20,600 | 30,100 | 35,000 | 45,800 |
| St. Louis-San Francisco Railroad | 31.0 | 11,500 | 16,800 | 19,500 | 25,500 |
| Scullin Railroad Spur | 28.2 | 10,400 | 15,100 | 17,600 | 23,100 |
| ROCK CREEK | | | | | |
| Germania Street | 2.8 | 3,400 | 5,000 | 5,400 | 7,000 |
| NO NAME CREEK | | | | | |
| River Des Peres Boulevard | 4.7 | 3,800 | 5,800 | 6,700 | 9,100 |
| DEER CREEK | | | | | |
| St. Louis-San Francisco Railraod | 36.5 | 13,000 | 18,700 | 22,000 | 28,600 |

## 3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each stream studied in detail.

The 10-, 50-, 100-, and 500-year frequency flood profiles for the Mississippi River are based on model test results by the COE Waterways Experiment Station, Vicksburg, Mississippi (Reference 5).

Water-surface elevations of floods of the selected recurrence intervals on River Des Peres, No Name Creek, and Rock Creek were computed through use of COE HEC-2 Step-Backwater computer program (Reference 12).

Starting water-surface elevations for River Des Peres, No Name Creek, and Rock Creek were dictated by backwater effects from the receiving stream. In floodway analysis, starting water-surface elevations were assumed at critical depth as low flow profiles on all receiving streams were below that elevation.

Channel roughness factors (Manning's "n") for these computations were assigned on the basis of field inspection of flood plain areas. Overbank areas were for the most part urbanized. A value of 0.045 was assumed as being an average representation of the area not covered by structures. As the entire channel is man-made and paved with regular side slopes channel values varies from 0.025 for straight sections to 0.035 for irregular alignments.

Valley and channel cross sections were surveyed at selected locations to determine hydraulic characteristics. The locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3). Topographic maps, which were provided by the City of St. Louis with five-foot contour intervals were used to supplement field cross sections.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5-foot for floods of the selected recurrence intervals (Exhibit 1). All elevations used in this study are measured from NGVD; elevation reference marks used in this study are shown and described on the maps.

The flood elevations, as shown on the profiles, are considered valid only if hydraulic structures in general remain unobstructed, and flood control structures do not fail.

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Some portions of the community which are protected from the Mississippi River by floodwalls or levees are subject to localized flash flooding from a 100-year event due to inadequate drainage facilities. The delineation of flood outlines for these areas was based on narrative descriptions contained in various Design Memorandums prepared by the St. Louis District COE for the Flood Protection Project (Reference 13).

## 4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage state and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

### 4.1 Flood Boundaries

In order to provide a national standard without regional discrimination the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For streams in the River Des Peres Basin which were studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated on the Flood Boundary and Floodway Map (Exhibit 3) using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps furnished by the City of St. Louis at a scale of 1:2,400, with a contour interval of five feet (Reference 14). Along the Mississippi River the 100-year and the 500-year flood boundaries have been delineated using the flood profiles determined by the COE model test and applying these elevations to USGS topographic maps. Between indicated contour intervals, the boundaries were interpolated. In cases where the 100-year and the 500-year boundaries are close together, only the 100-year boundary has been shown.

### 4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried

without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways proposed for this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2). As shown on the Flood Boundary and Floodway Map (Exhibit 3), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Some floodways, which closely follow stream courses, have not been delineated on the Floodway Boundary and Floodway Map due to scale limitations. They are, however, tabulated in Table 2.

Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | |
|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH[2] (FEET) | SECTION AREA (SQ. FEET) | MEAN VELOCITY (FEET/SEC.) | WITH FLOODWAY (FEET NGVD) | WITHOUT FLOODWAY (FEET NGVD) | DIFFERENCE |
| MISSISSIPPI RIVER | | | | | | | |
| A | 172.40 | 5033 | 158,095 | 6.5 | 421.6 | 421.1 | 0.5 |
| B | 174.40 | 4747 | 175,293 | 5.8 | 423.2 | 422.7 | 0.5 |
| C | 175.80 | 5400 | 191,029 | 5.3 | 424.3 | 423.8 | 0.5 |
| D | 177.90 | 2440 | 125,114 | 8.2 | 426.1 | 425.6 | 0.5 |
| E | 178.82 | 2480 | 125,092 | 8.2 | 426.9 | 426.4 | 0.5 |
| F | 179.31 | 2503 | 126,322 | 8.1 | 427.3 | 426.8 | 0.5 |
| G | 180.03 | 2510 | 129,349 | 7.9 | 428.0 | 427.5 | 0.5 |
| H | 181.33 | 2449 | 133,785 | 7.6 | 429.1 | 428.7 | 0.4 |
| I | 182.53 | 2343 | 129,853 | 7.9 | 430.7 | 429.8 | 0.4 |
| J | 183.23 | 2607 | 125,669 | 8.1 | 430.2 | 430.3 | 0.4 |
| K | 184.57 | 3623 | 192,598 | 5.3 | 432.3 | 431.9 | 0.4 |
| L | 187.40 | 12,778 | 402,747 | 2.5 | 433.6 | 433.2 | 0.4 |
| M | 189.45 | 6300 | 279,685 | 3.6 | 433.8 | 433.5 | 0.3 |
| N | 190.53 | 5870 | 207,758 | 4.9 | 434.0 | 433.6 | 0.4 |
| O | 190.77 | 5250 | 195,107 | 5.2 | 434.1 | 433.7 | 0.4 |

[1]MILES ABOVE CONFLUENCE WITH OHIO RIVER
[2]THIS WIDTH EXTENDS BEYOND CORPORATE LIMITS

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TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

**CITY OF ST. LOUIS, MO**
**(INDEPENDENT CITY)**

**FLOODWAY DATA**

**MISSISSIPPI RIVER**

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | |
|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQ. FEET) | MEAN VELOCITY (FEET/SEC.) | WITH FLOODWAY (FEET NGVD) | WITHOUT FLOODWAY (FEET NGVD) | INCREASE (FEET) |
| RIVER DES PERES | | | | | | | |
| A | 765 | 203 | 3429 | 14.00 | 402.5 | 402.5[2] | 0.0 |
| B | 4040 | 239 | 3885 | 12.35 | 408.0 | 408.0[2] | 0.0 |
| C | 6380 | 259 | 4179 | 10.87 | 410.7 | 410.7[2] | 0.0 |
| D | 9640 | 344 | 5270 | 7.65 | 414.0 | 414.0[2] | 0.0 |
| E | 11,730 | 246 | 4356 | 9.25 | 414.7 | 414.7[2] | 0.0 |
| F | 15,290 | 268 | 4356 | 8.95 | 418.4 | 417.5[2] | 0.9 |
| G | 19,570 | 234 | 4215 | 9.25 | 420.8 | 419.9[2] | 0.9 |
| H | 22,940 | 214 | 3503 | 11.13 | 422.6 | 422.0 | 0.6 |
| I | 26,340 | 213 | 3467 | 10.09 | 425.6 | 425.4 | 0.2 |
| J | 28,470 | 216 | 3885 | 9.01 | 429.6 | 428.7 | 0.9 |
| K | 31,960 | 216 | 3916 | 8.94 | 432.2 | 431.3 | 0.9 |
| L | 34,160 | 111 | 1803 | 10.81 | 435.2 | 434.6 | 0.6 |
| M | 36,917 | 100 | 1832 | 10.64 | 438.4 | 438.3 | 0.1 |
| N | 38,380 | 110 | 1893 | 10.30 | 439.9 | 439.2 | 0.7 |
| O | 41,520 | 114 | 1950 | 10 00 | 444.2 | 443.6 | 0.6 |
| P | 43,370 | 119 | 2240 | 7.86 | 446.3 | 445.9 | 0.4 |
| Q | 46,520 | 96 | 1795 | 9.81 | 451.0 | 450.7 | 0.3 |
| R | 49,675 | 182 | 2998 | 5.87 | 455.5 | 455.1 | 0.4 |

[1]FEET ABOVE MOUTH
[2]WATER-SURFACE ELEVATIONS WITHOUT CONSIDERATION OF BACKWATER EFFECTS FROM THE MISSISSIPPI RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

**CITY OF ST. LOUIS, MO**
**(INDEPENDENT CITY)**

**FLOODWAY DATA**

**RIVER DES PERES**

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | |
|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQ. FEET) | MEAN VELOCITY (FEET/SEC.) | WITH FLOODWAY (FEET NGVD) | WITHOUT FLOODWAY (FEET NGVD) | INCREASE (FEET) |
| ROCK CREEK | | | | | | | |
| S | 1035 | 69 | 904 | 6.02 | 421.0 | 420.2[2] | 0.8 |
| T | 2835 | 24 | 419 | 16.59 | 421.4 | 420.5 | 0.9 |
| NO NAME CREEK | | | | | | | |
| U | 345 | 86 | 1165 | 5.73 | 424.8 | 424.3 | 0.5 |
| V | 815 | 67 | 830 | 8.05 | 424.8 | 424.5 | 0.3 |
| DEER CREEK | | | | | | | |
| W | 270 | 110 | 1625 | 13.54 | 431.9 | 430.9[2] | 1.0 |

[1]FEET ABOVE CONFLUENCE WITH RIVER DES PERES
[2]WATER-SURFACE ELEVATION WITHOUT CONSIDERATION OF BACKWATER EFFECT FROM RIVER DES PERES

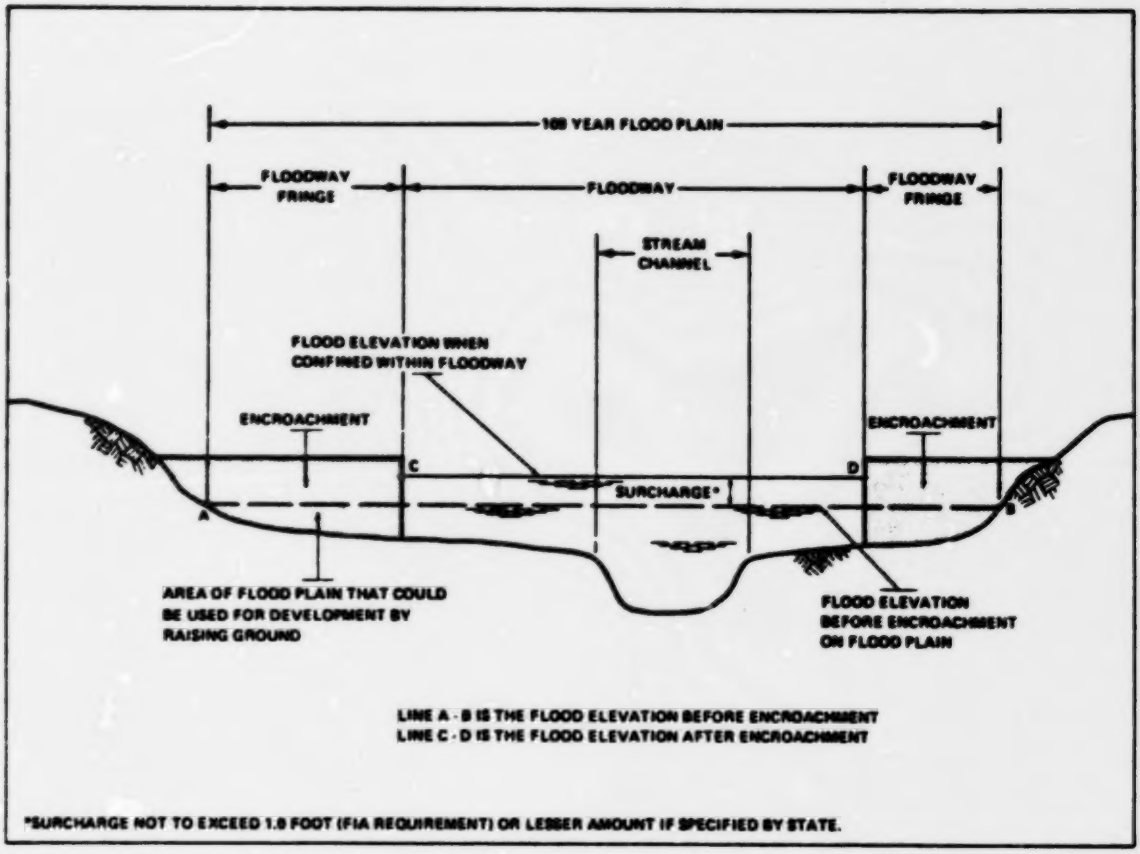
TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

**CITY OF ST. LOUIS, MO**
**(INDEPENDENT CITY)**

**FLOODWAY DATA**

**ROCK CREEK—NO NAME CREEK—DEER CREEK**


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

**FLOODWAY SCHEMATIC** Figure 2

Along some parts of the streams, encroachments may be made without surpassing the FIA criteria defining an acceptable floodway. Specific locations on and transverse distances for permissible encroachments into the natural flood plain can and should be determined only in combination with specific localized land use proposals to the City of St. Louis.

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## 5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source studied in detail affecting the City of St. Louis.

### 5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

| Average Difference Between 10- and 100-Year Floods | Variation |
|---|---|
| 2 to 7 feet | 1.0 foot |
| 7.1 to 12 feet | 2.0 feet |

Six reaches meeting the above criteria were requried for the flooding sources studied in detail. The Mississippi River was characterized by one reach; River Des Peres was characterized by three reaches; Rock Creek was characterized by one reach; and No Name Creek was characterized by one reach. The locations of the reaches are shown on the Flood Profiles (Exhibit 1).

### 5.2 Flood Hazard Factors

The FHF is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

## 5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the City of St. Louis was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations.

| | |
|---|---|
| Zone A: | Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined. |
| Zones A8, A12, A13, A17, A20: | Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHFs. |
| Zone B: | Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided. |
| Zone C: | Areas of minimal flooding. |

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevation for each flooding source studied in detail in the community.

## 5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of St. Louis is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

| FLOODING SOURCE | PANEL[1] | ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND | | | FLOOD HAZARD FACTOR | ZONE | BASE FLOOD EIEVATION[3] (FEET NGVD) |
|---|---|---|---|---|---|---|---|
| | | 10% (10-YEAR) | 2% (50-YEAR) | 0.2% (500-YEAR) | | | |
| MISSISSIPPI RIVER | | | | | | | |
| REACH 1 | 0005,0010,0030 0040 | -10.3 | -2.7 | 3.8 | 100 | A20 | VARIES—SEE MAP |
| RIVER DES PERES | | | | | | | |
| REACH 1 | 0040 | - 5.8 | -2.0 | 4.7 | 060 | A12 | VARIES—SEE MAP |
| REACH 2 | 0020,0040 | - 6.5 | -2.3 | 4.6 | 065 | A13 | VARIES—SEE MAP |
| REACH 3 | 0020 | - 8.4 | -2.8 | 4.6 | 085 | A17 | VARIES—SEE MAP |
| ROCK CREEK | | | | | | | |
| REACH 1 | 0040 | - 3.9 | -1.2 | 2.8 | 040 | A8 | VARIES—SEE MAP |
| NO NAME CREEK | | | | | | | |
| REACH 1 | 0040 | - 6.0 | -1.7 | 5.3 | 060 | A12 | VARIES—SEE MAP |

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

**CITY OF ST. LOUIS, MO**
**(INDEPENDENT CITY)**

**FLOOD INSURANCE ZONE DATA**

**MISSISSIPPI RIVER—
RIVER DES PERES—ROCK CREEK—NO NAME CREEK**

## 6.0 OTHER STUDIES

A Flood Insurance Study for the unincorporated areas of St. Louis County, Missouri is under preparation by the St. Louis District COE and will be coordinated with this study (Reference 15).

Flood Insurance Studies for the cities of University City, Jennings, Mackenzie, and Bellefontaine Neighbors, Missouri are under preparation by R.W. Booker and Associates, Inc., and will be coordinated with this study (Reference 16). This study is authoritative for purposes of the Flood Insurance Program.

## 7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Federal Insurance Administration, Regional Director, Federal Office Building, 911 Walnut Street, Kansas City, Missouri, 64106.

## 8.0 BIBLIOGRAPHY AND REFERENCES


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2. Missouri Department of Natural Resources, Outdoor Recreation Plan, September 1976.

3. U.S. Department of Agriculture, Soil Conservation Service, Interim Soil Survey, Information and Interpretations, St. Louis County and St. Louis City, Missouri, 1976.

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14. City of St. Louis, Topographic Maps, Scale 1:2,400, Contour Interval 5 feet, undated.

15. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study of the Unincorporated Areas of St. Louis County, Missouri, U.S. Army Corps of Engineers, St. Louis District, (in progress).

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## 9.0 REVISIONS DESCRIPTION

This section has been added to provide information regarding significant revisions made since the original Flood Insurance Study was printed. Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood hazard data located at the Permit Section, City Hall, Market and Tucker Streets, St. Louis, Missouri.

### 9.1 First Revision (Revised September 16, 1988)

a. Acknowledgments

The hydraulic analysis for this Revisions Description was performed by the U.S. Army Corps of Engineers (COE), St. Louis District. The Federal Emergency Management Agency reviewed and accepted these data for purposes of this revision.

b. Scope

The floodway was revised for the entire reach of the Mississippi River within the City of St. Louis, Missouri.

c. Hydraulic Analysis

The floodway revision for the Mississippi River was based on a HEC-2 hydraulic analysis (Reference 17). The floodway was delineated by the COE using topographic maps at a scale of 1:24000 with a contour interval of 10 feet (Reference 18).

d. Floodways

Floodway computations for the Mississippi River were revised as a result of the new hydraulic analysis.

The floodways were computed on the basis of a conveyance reduction from each side of the floodplain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was revised and are presented in Table 2, Floodway Data.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point.

e. Other Studies

The Flood Insurance Study for St. Louis County, Missouri (Reference 19) is being revised and is in agreement with this revised study.

f. References and Bibliography


17. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, April 1984.

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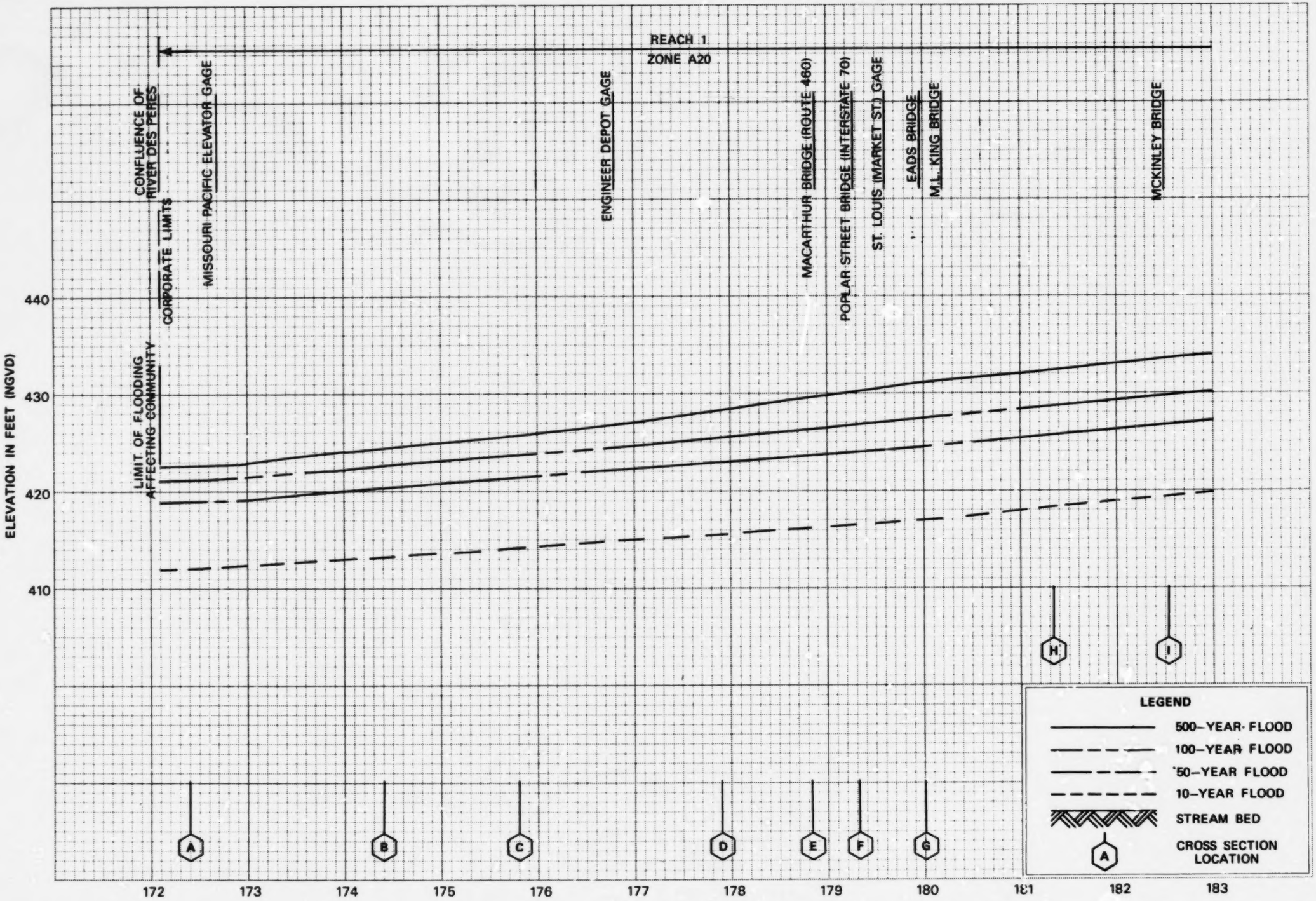
19. Federal Emergency Management Agency, Flood Insurance Study, St. Louis County, Unincorporated Areas, Missouri, December 1985, revision in progress.

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# FLOOD PROFILES

## MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

**CITY OF ST. LOUIS, MO**
(INDEPENDENT CITY)

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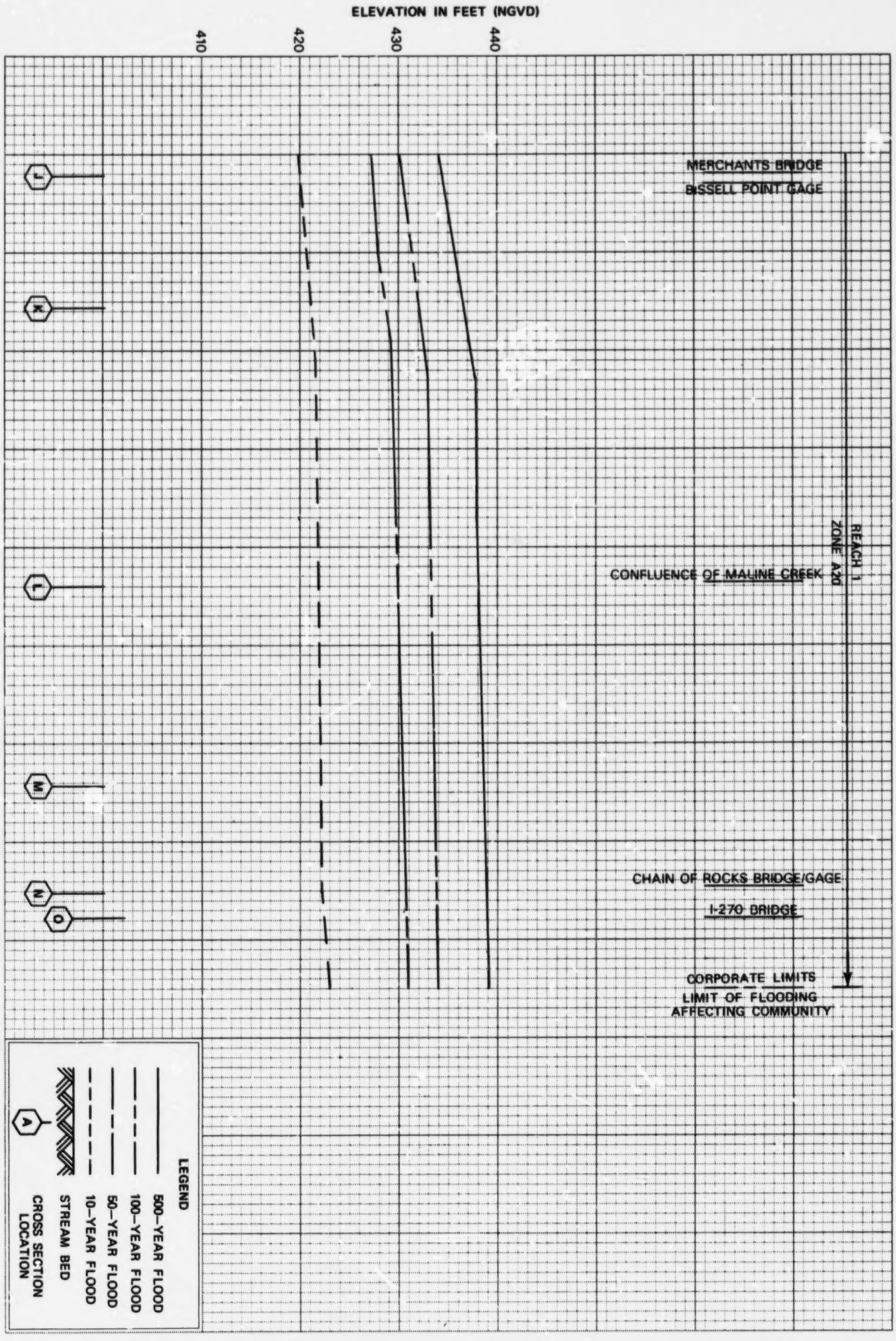


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FEDERAL EMERGENCY MANAGEMENT AGENCY

**CITY OF ST. LOUIS, MO**
(INDEPENDENT CITY)

**FLOOD PROFILES**

**MISSISSIPPI RIVER**

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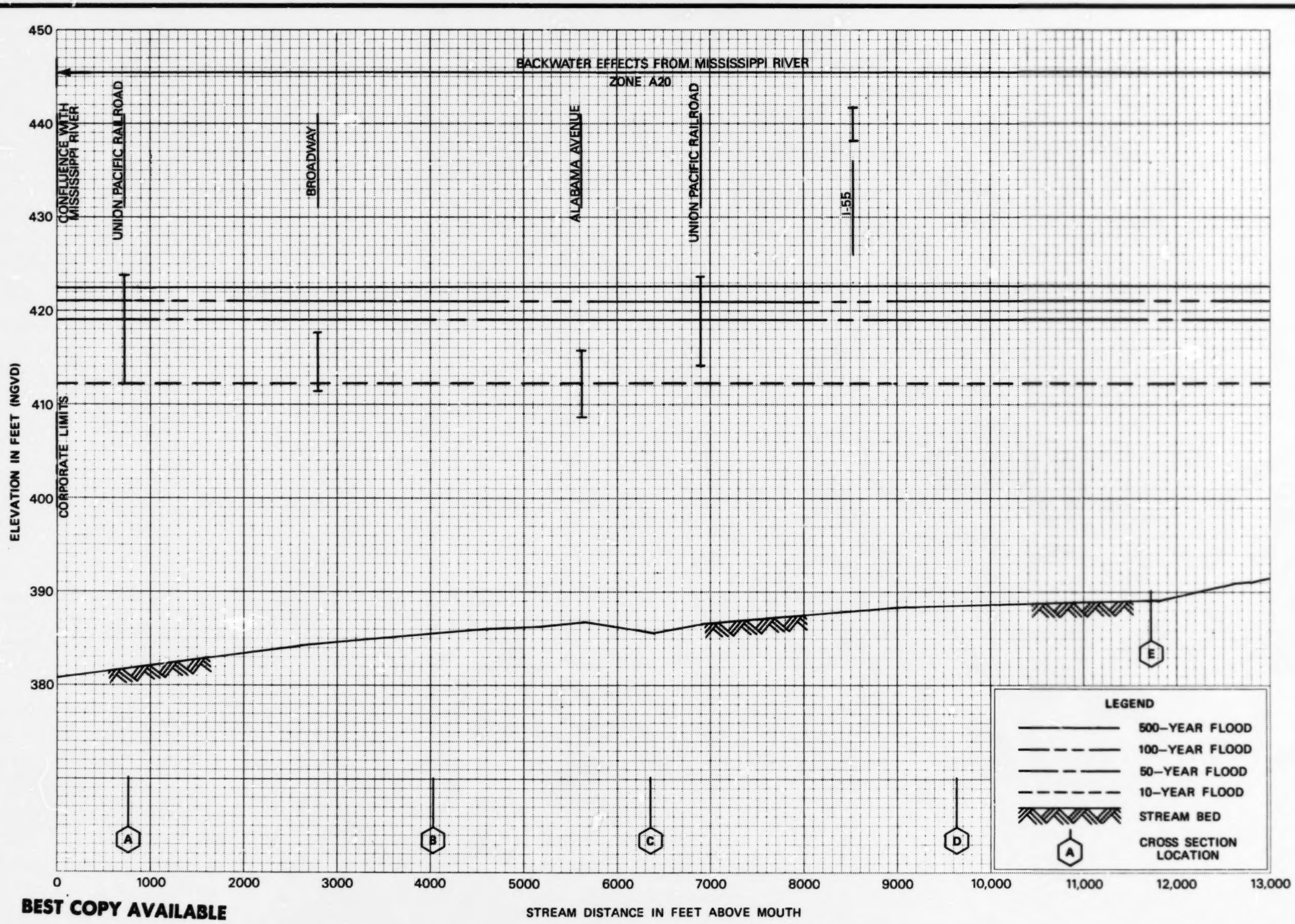


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**FLOOD PROFILES**

**RIVER DES PERES**

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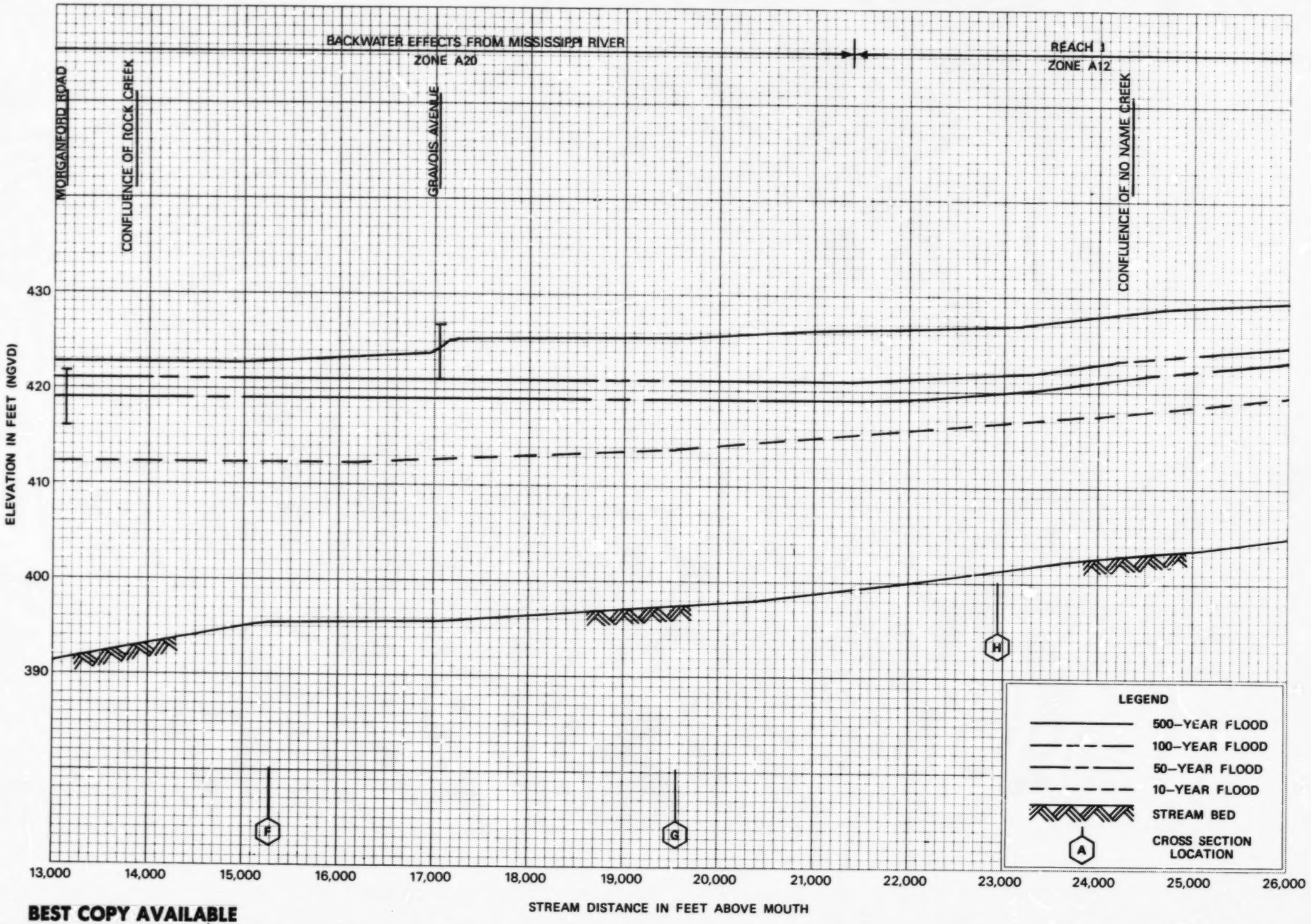


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**FLOOD PROFILES**

**RIVER DES PERES**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**CITY OF ST. LOUIS, MO**
(INDEPENDENT CITY)

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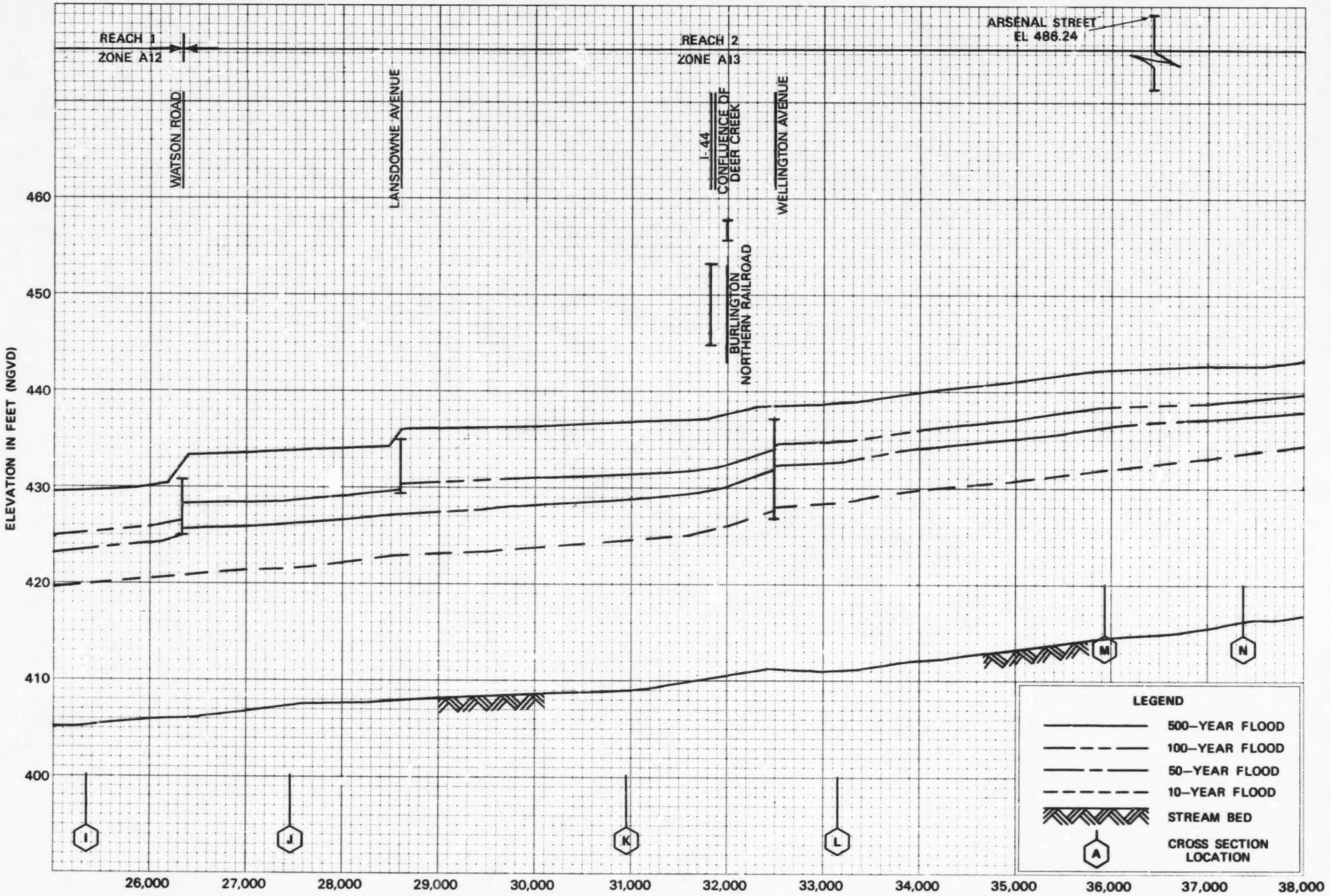


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**FLOOD PROFILES**

**RIVER DES PERES**

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**CITY OF ST. LOUIS, MO**
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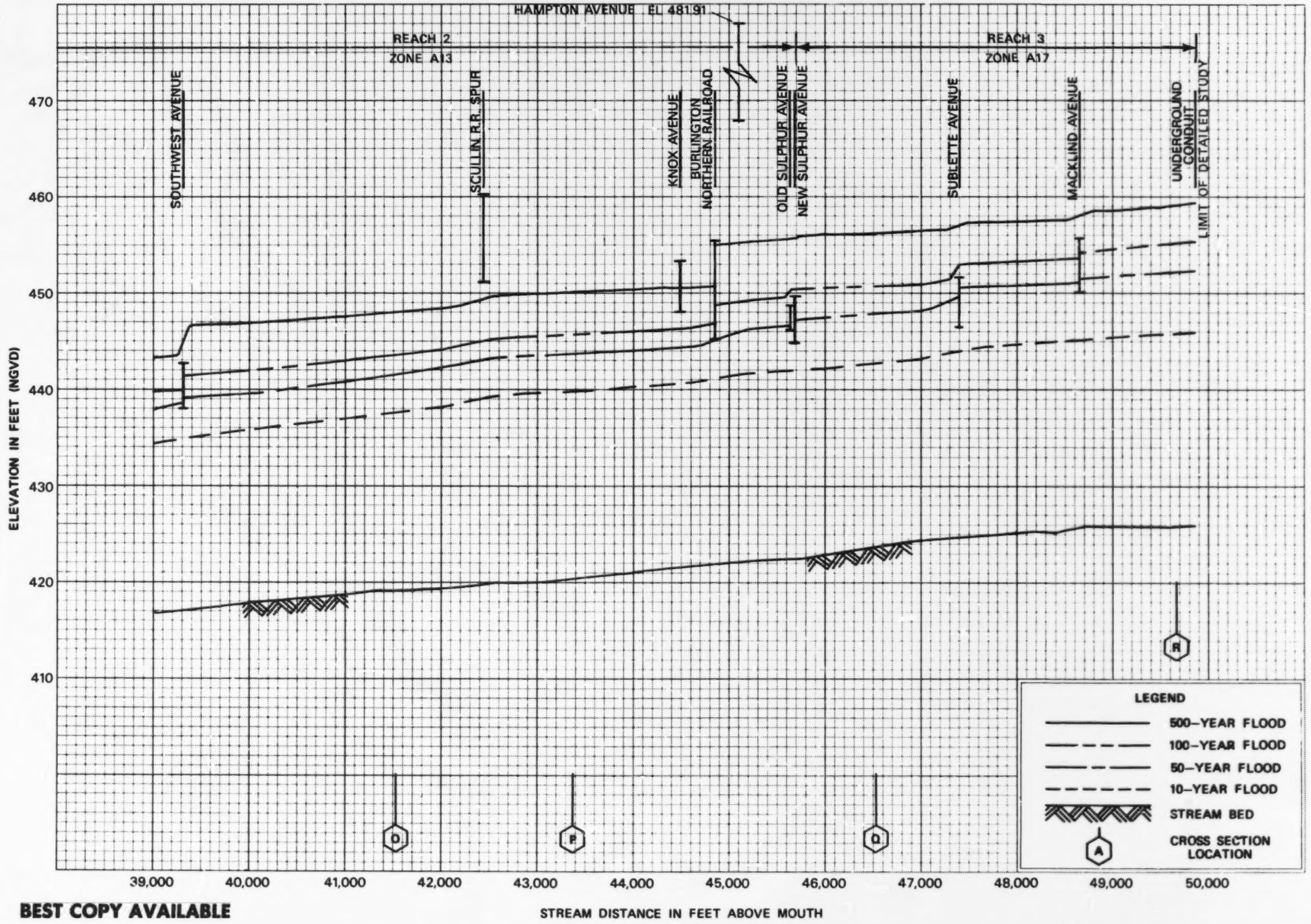


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**FLOOD PROFILES**

**RIVER DES PERES**

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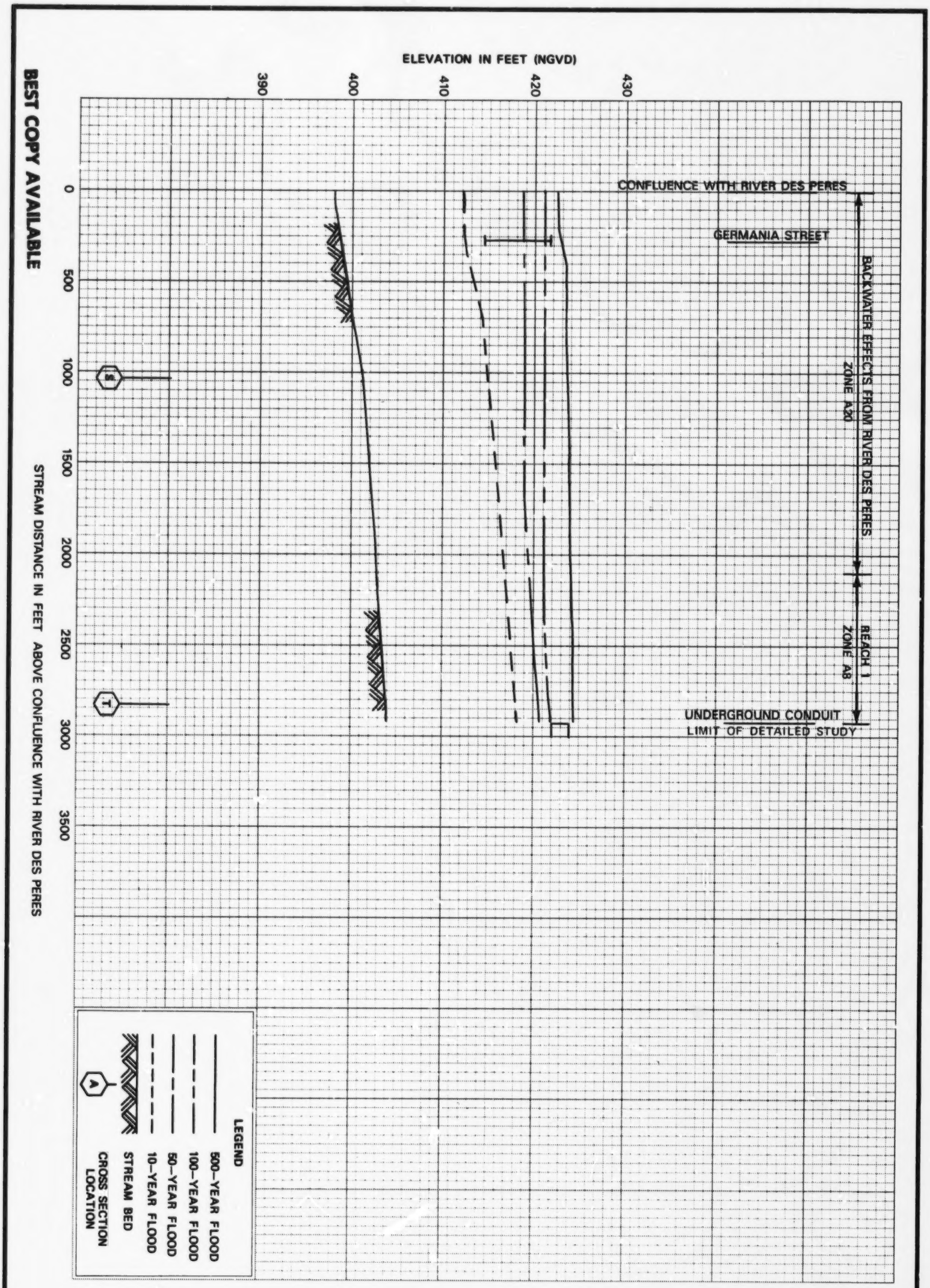


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| 07P | FEDERAL EMERGENCY MANAGEMENT AGENCY<br>CITY OF ST. LOUIS, MO<br>(INDEPENDENT CITY) | FLOOD PROFILES<br>ROCK CREEK |
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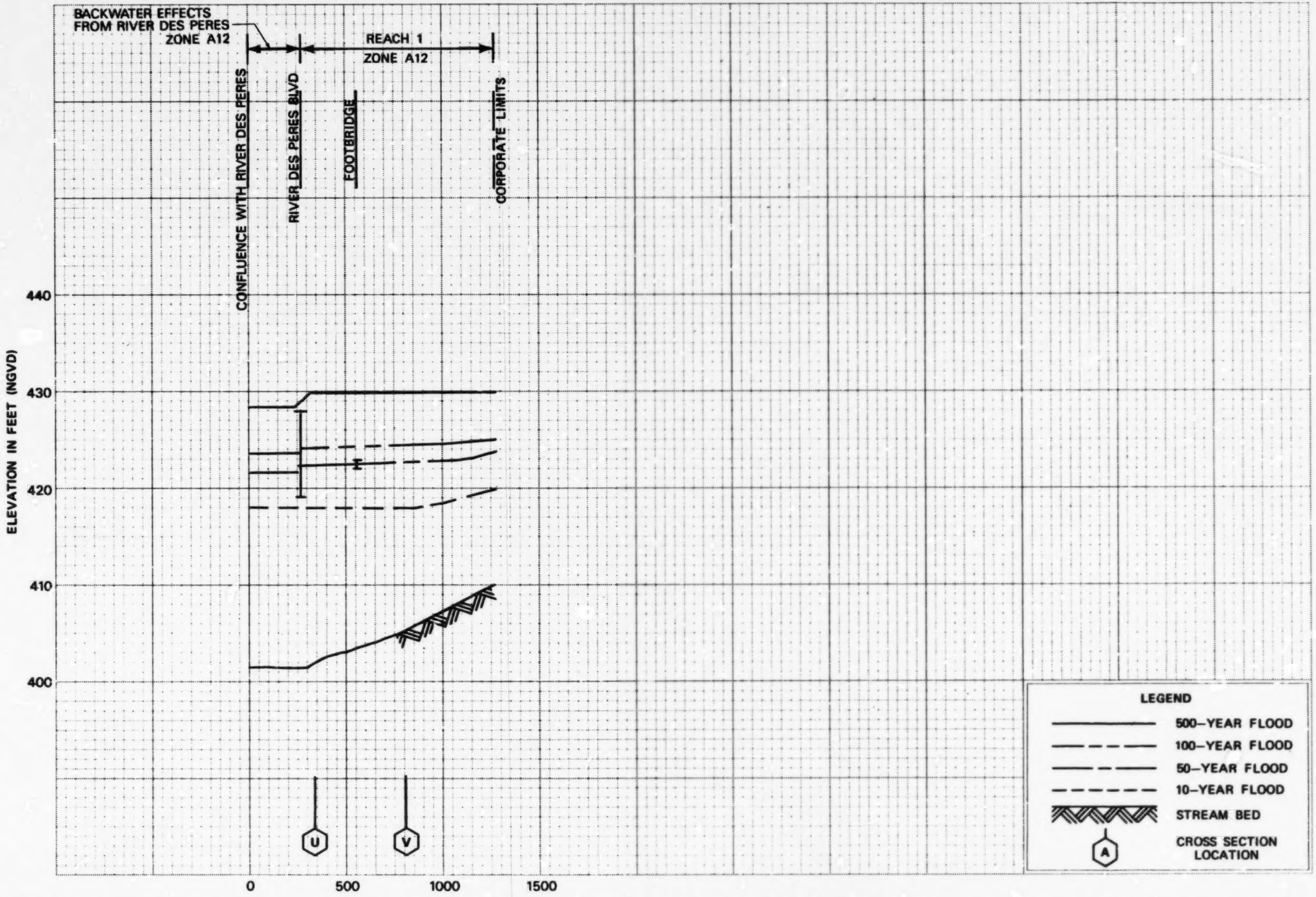


FLOOD PROFILES

NO NAME CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF ST. LOUIS, MO
(INDEPENDENT CITY)

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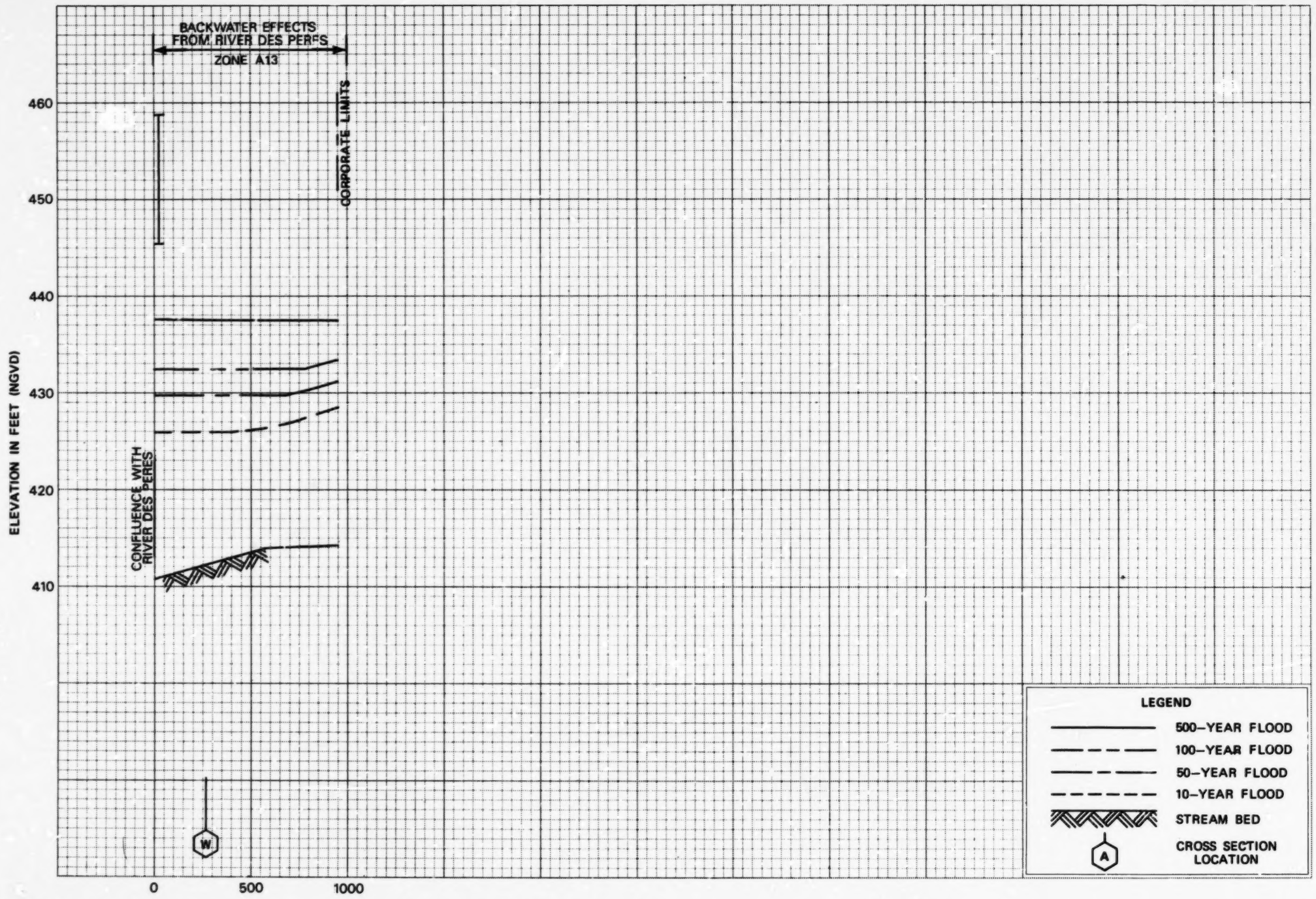


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**FLOOD PROFILES**

**DEER CREEK**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**CITY OF ST. LOUIS, MO**
(INDEPENDENT CITY)

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